POPULAR MECHANICS

An Illustrated Weekly Review of the Mechanical Press of the World

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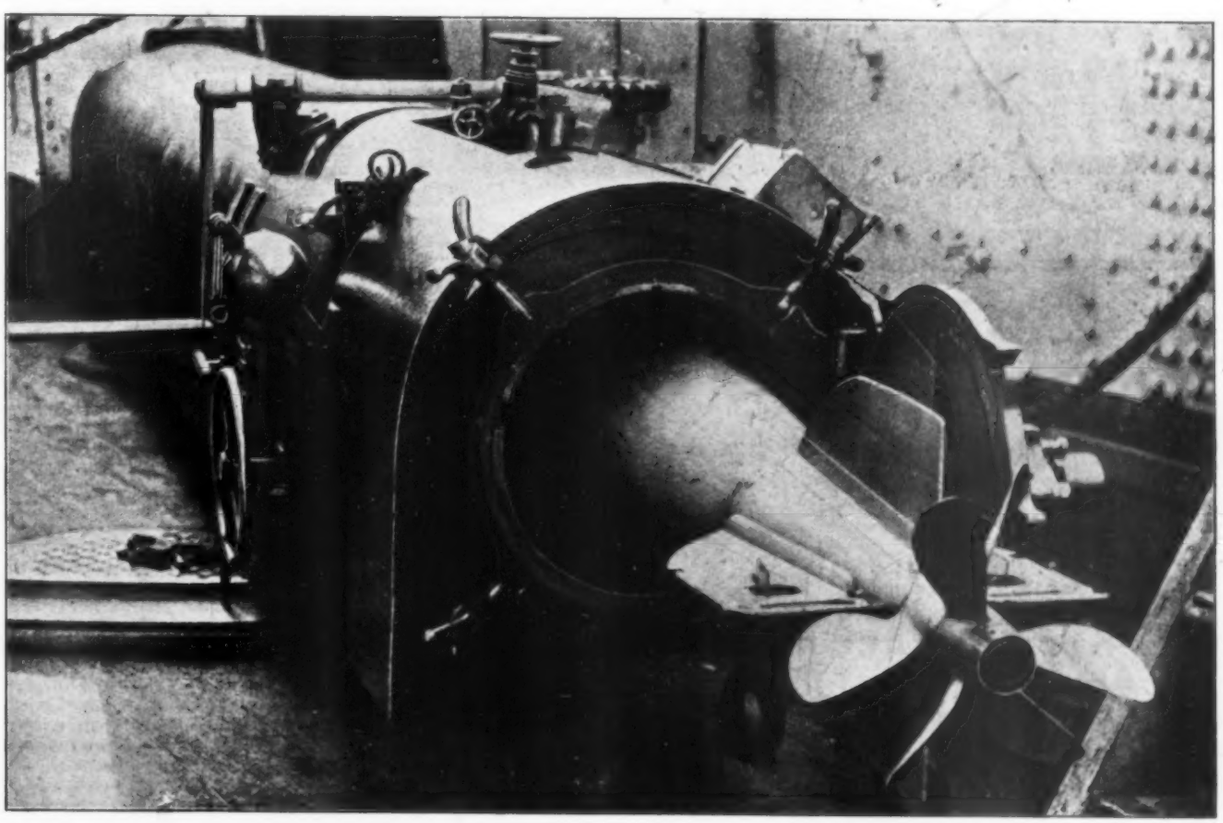
Vol. 3. No. 24. CHICAGO, JUNE 13, 1903. PRICE 5 CENTS.

War's Most Destructive Weapon—The Torpedo



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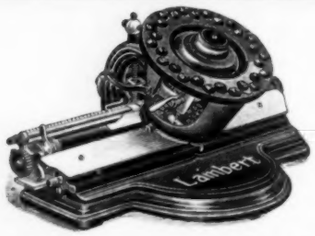

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AMERICA CONTROLS PIG IRON MARKET.

Scottish Paper Compliments Us for the Manner in Which We Averted European Depression.

In a review of the pig iron trade of last year a writer in the Scotsman, of Edinburgh, Scotland, says the American demand and American reports have dominated the pig iron markets of the whole world to the exclusion of all other influences, and that the iron market must now look to America for guidance, as she has proved her power of taking on her shoulders the burden of what threatened to be an almost universal depression, and converting it into a semblance of prosperity. The writer states: Russia, hitherto a pig iron importing country, exported to America last year over 32,000 tons of pig iron; Germany sent her immense quantities of pig iron and manufactured steel; even France contributed supplies; and Cleveland, west coast hematite and Scottish pigs owe all their advances and their present stability entirely to America. America last year absorbed from Europe a total of considerably over 1,000,000 tons of pig iron, manufactured iron and steel, and this in addition to the consumption of her own enormous production, which should amount to more than 18,000,000 tons. To Germany this unexpected demand must have proved an unmixed blessing, rescuing her from what was fast approaching a commercial crisis.

Admiration cannot be withheld from the Americans for the sensible, calm way in which their purchases have been effected throughout the whole year. Purchases even mildly approximating to the present totals would in former years have sent the pig iron markets wild with excitement, but this year it would appear almost as if America's total purchases were directed from one office desk, so judiciously have her demands been regulated and spread over the various markets at her disposal—buying one week in Germany, the next week here, and always allowing a market to get repose whenever it appeared to get excited over her purchases.

America still continues to purchase fair quantities here and there, and it is quite certain that well into March next extensive shipments from European ports must take place on her account. But the question is ever being asked, At what period will this American demand cease? Only about two years ago America was flooding the Continent and Great Britain with her pig iron and manufactured steel, and the argument is permissible that the enormous increase in America's production which has taken place in response to her sudden burst of prosperity must sooner or later overtake her consumption and perhaps leave something to spare for export.

FUTURE OF THE KITE.

The kite, by giving facilities of observation at great heights, is becoming a valuable means in the extension of the boundaries of meteorology. According to the secretary of the Aeronautical Society of Great Britain, the kite is, after all, the base of what we expect will be the future instrument of aerial navigation, the aeroplane.

Brilliance of Modern Exposition Illuminations

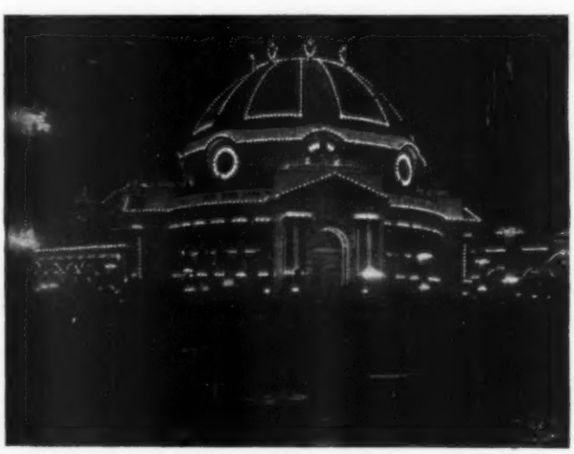
Light Effects as They Were Never Seen Before to be Produced at St. Louis World's Fair

An Indian girl who came to Chicago from the Indian Territory not long ago and strolled along State street at night, compared the city with its lights to her idea of Heaven. What might she think if she was permitted to gaze on the brilliant illuminations of a modern international exposition? With the late electrical appliances, light effects are produced such as our fathers never dreamed of in earthly vision. Science and electric skill seem to have exerted themselves in the making of gorgeous displays of lights, which have been seen to the acme of their perfection at the recent expositions in America and Europe. But in America this science is much further advanced than elsewhere. The expositions at Buffalo, Omaha, Atlanta, Charleston and at Chicago were all revelations to European visitors.

Illumination of Fine Arts Building, Omaha Exposition

But more magnificent than all the previous displays will be the illuminations at the world's fair in St. Louis. There will be fountains of liquid light, electric flower beds bursting forth in blossoms of different hue that fade and bloom and change their color as one looks on. It will seem that all of the lights of the night will have been concentrated into this one gorgeous illumination display. Buildings will appear to be made of fire. They will blaze forth with one magnificent glare of light, hide themselves in darkness again, and then the lights will crawl about the eaves and walls and pillars of the mansions, flit along the water's edge, and even in the water, as if the lights were a real living organism that traveled with the speed of lightning.

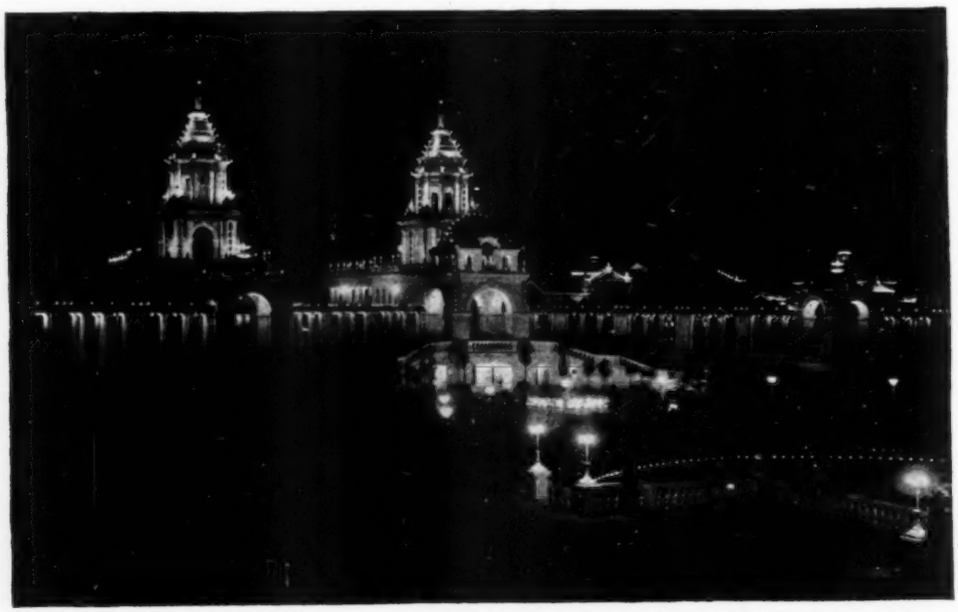
To the General Electric Company, which has furnished most of the electric displays for past expositions, is due most of the credit for the wonderful advancement our nation has made in this splendid art. The illuminations are produced through the medium of electric transformers located throughout the exposition grounds. At the Pan-American exposition, Niagara Falls power passed through General Electric transformers continuously during the open period of the



"Temple of Music," Pan American Exposition

Tower of Light, Atlanta Exposition

exposition. The large transformers in the primary circuit were located in the electricity building and were of the air-blast type. The current was distributed from the switch-board at the company's exhibit through various places about



Illumination of Grand Court, East End, Omaha Exposition

the grounds where the Type H oil-cooled transformers were located. The same general method was employed in former expositions.

HOW TO RAISE OYSTERS.

Professor John A. Ryder, of Johns Hopkins University, and other scientists of renown, have by experiments made it possible for anyone near salt water with ordinary care to produce young oysters. The method is exceedingly simple, and the experiments will no doubt result in correcting the scarcity of mollusks which prevails by reason of overfishing.

Producing oysters by artificial methods consists merely in aiding nature in her work of reproducing the species. An oyster is taken and the shell opened so that the animal lies in the deeper shell. The upper surface of the oyster is then stroked gently away from the hinges with an ordinary glass pipette. If the mollusk is ready to spawn this stroking will cause it to emit a fluid which, if the oyster be a female, will be full of tiny eggs, microscopical in size. A few drops of this liquid is taken up by the pipette and put into a tumbler of sea water, as is also a drop or two of liquid from a male oyster. The eggs and male cells thus come together in the water and are fertilized in the natural way. In a couple of hours the eggs will have hatched, and thousands of young oysters will be floating in the tumbler. For a couple of days the young oysters will swim about, but at the end of that time they will have grown a glassy shell and will be ready to attach themselves to some solid substance. During the swimming stage thousands of them are very likely in their natural state to be devoured by fishes or by adult oysters.

It is after a young oyster attaches itself to a solid object of any kind that it begins to grow a lime shell. The larval shell remains attached to the new shell until it finally wears off. Care must be taken that the oysters have solid objects on which to attach themselves, as many perish for lack of a proper place to settle, or they suffocate in the mud.

The possibilities of producing oysters by artificial means are great, since a single female oyster in a single spawning season will produce 16,000,000 to 40,000,000 eggs. It is estimated that 90 per cent of the eggs may be impregnated and hatched. A tumbler of sea water will hold 100,000 of the newly hatched oysters.

REDUCING WEIGHT OF WARSHIPS.

It seems to be the general opinion of naval experts that the weight of warships should be reduced, but the difficulty in the way is just how this is to be done without decreasing the efficiency of the man-of-war, either on the offensive or defensive. Nearly all are agreed that this reduction in weight must come from small weight savings in innumerable instances—but where begin?

Recently Mr. W. H. Whiting read a paper in this connection before a meeting of the British Institution of Naval Architects. Among other things Mr. Whiting suggested that frequently ship fittings and stores might be omitted with advantage. He further cited that many labor-saving devices, making more weight and calling for more power, are introduced while, as a result, the large crews necessarily kept by the men-of-war for fighting purposes ofttimes have little to do and must have exercising apparatus to keep them in good condition. The size and fitting of officers' quarters and equipment of comfort and convenience were also shown to contribute much weight. An unusual point urged by Mr. Whiting was that in a desire to make the ships look smart so much paint is used that an enormous weight is added. He illustrated this point by a case where there was removed from the inner surface of a warship, paint of a weight of over two pounds to the square foot.

In a letter to The Engineer, London, on the subject under discussion, Lieut. Carlyon Bellairs suggests that the ram be dispensed with and thirty-five tons saved. The Engineer in commenting upon this suggestion, declares it is not practical since, to avoid torpedos and allow the end-on tactics now in use, a ship must come end-on. An enemy appears before her. She cannot turn because of the danger of being torpedoed and only the ram or, as a substitute, the bow torpedo tube, allows her to go ahead. The after conning tower with its ten tons of weight also came in for condemnation, but it seems to be necessary since it holds the directors of the after submerged tubes and forms a second steering position. Mining gear at six tons weight seems to have come to stay, as the possible uses of mines in actual warfare are many and vital. Then there are the torpedo nets which weigh twenty-five tons or more, but submarine boats which cannot be battled with have served to make these a necessary equipment. In the case of the American man-of-war the torpedo has been abolished, but all attempts to sacrifice strength and efficiency to save weight have proven disastrous.

The ever increasing tendency in the building of warships seems to be greater weight and greater cost. A saving must be effected, but where it is to be made is yet an unsettled problem.

The Mechanism of a Modern Torpedo

On the front page is an illustration of a torpedo tube, from which is discharged the torpedo, the most terrible weapon of naval warfare. There are four varieties of tubes—above-water, submerged, revolving and dropping-gear. The one shown here is the water tube and weighs about five tons. The torpedo is discharged from the tube in two ways, by compressed air or by a light charge of powder.

It is the torpedo itself, however, that is of the greatest interest. The torpedo in general use may be fired a distance of 2,000 yards. It is so arranged that it cannot explode and injure the vessel from which it is fired, it is propelled and guided by power from within itself in such a way that it cannot be deflected in any direction from the course for which it has been set, and when it comes in contact with a solid object, it explodes with such a force as to make an opening forty-four feet square in the double bottom of the strongest iron clad ship made.

The torpedo, which is called the "baby" by the seamen, is in shape like a cigar, measures fourteen to eighteen feet in length and is fourteen or eighteen inches in diameter in the thickest part. The 18-inch torpedo has a speed of 32 knots for 2,000 yards, carries a charge of 133 pounds of wet gun cotton, and weighs 1,150 pounds. The 14-inch projectile has a speed of 30 knots for 2,000 yards, carries a charge of 115 pounds, and weighs 706 pounds. The torpedo is divided into compartments. It is in the first of these that the deadly charge is placed. A pointed rod is placed at the head and when the torpedo hits a solid object the rod is driven back against a detonator of fulminate of mercury which explodes the charge. To prevent the explosion of the torpedo as it leaves the ship a collar is placed over the end of the rod. This collar is arranged so as to work off after going in the water about thirty yards and thus the end of the rod is exposed. Next to the explosive chamber comes the air chamber where the motive power of the torpedo is stored. Behind this is the balance chamber, where is located the automatic apparatus which by means of four rudders keeps the torpedo exactly in the course for which it is set and which will not allow it to swerve right or left, up or down. Back of this are the engines, worked by compressed air, which revolve two screw propellers. The latter work in opposite directions, keeping the torpedo upright. The next chamber is the buoyancy chamber which gives to the torpedo its necessary buoyancy. In the tail of the torpedo are carried the level-wheel apparatus, governing the propellers, and the rudders and propellers. Here is also located the mechanism for controlling the length of run.

The torpedo of late years has undoubtedly come into high favor and many believe that it will replace the ram. Others go so far as to state that the torpedo will surpass in importance the gun.

BREAKING CAMP.

The state of Montana has recently issued a magnificent book of nearly a thousand pages to show the growth of their state since the day of the Louisiana purchase to the present time. The scene represented here is one that becomes rarer each month, but may still be seen in some portions of the state. The Indian squaw is the mainspring of family life.

Indians Breaking Camp

She is housebuilder, housekeeper, housemover and master of transportation. The lordly buck Indian does a heavy thinking part in the domestic drama. The picture shows the tepee all knocked down and packed on the poles. The pappoose is stacked in with the rest of the goods and the finishing touch awaited is the appearance of the husband and father, who will mount and ride the gayly caparisoned steed while the family drudge will walk behind to the next camp ground. The illustration is from the annual report of the Bureau of Agriculture, State of Montana.

America, with her Niagara, has the greatest total amount of water power in the world.

TUNNEL UNDER THE SEINE.

Work on a double tunnel under the Seine river in France, either at Tancarville or Quillebeuf, will probably soon be commenced. The tunnel will cost about $6,000,000 and will be the only means of getting across the Seine, save by boat, between Rouen and the sea. The construction will be in "fonte" or cast, wherever there is pressure, the distance between the top of the metallic tube and the lowest part of the river being 5.5 yards. The interior diameter of each tube will be 5.8 yards, leaving room for a small platform at each side for travellers, in case of accident or stoppage. The tunnel is the project of Jean Berlier, the French engineer, who expects to complete the work in three years with an equipment costing $231,600. Mr. Berlier has published an exhaustive pamphlet with map, drawings, etc., showing the result of his investigations on the proposed work and giving an outline of the manner in which the tunnel should be built. This pamphlet can be obtained from Mr. Berlier at 35 rue Boissy-d'Anglas, Paris, at a cost of 38.6 cents, not including postage.

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AUTOMATIC DANGER SIGNS FOR SHIPS.

An automatic system of signaling to vessels when approaching dangerous points on shore, is the invention of Prof. William Libbey of Princeton. The signals are given by means of wireless telegraph apparatus and are worked automatically. To secure service by this system, it is necessary for the vessel to be fitted with a receiving apparatus. The system is so arranged that warnings go out at three different distances, one at a radius of ten miles, one at five and one at two. When the vessel comes within one of these distances from the spot where the apparatus is located on shore, a bell will ring at the receiving appliance on the ship. As the signals differ at the two, five and ten-mile points, the vessel can tell how far she is from shore and also by computation get her bearings. This invention will prove unusually effective in case of fog when signal lights cannot be seen and also when the notes of fog whistles and bouys cannot be heard or located above the noise of wind and water.

PHOTOGRAPHY STOPS THIEVING.

All along the border line of Texas are numerous Mexicans who have moved over into the state. Many of them, especially the women, cannot resist the temptation of stealing articles exposed for sale in the stores. One merchant who was greatly troubled in this way hit upon a plan which has broken the practice up so far as his place is concerned. When a woman thief was caught he took her photograph before letting her go, and these pictures are displayed in the store where the clerks and customers can see them.

A German gives the editor this recipe for mince pie: "Get one piece of rubber and cut de under crust, scallop the edges mit de shears; buy four pounds of cow's neck; chop up von peck of apples, basket and all; add von yard of red flannel and a peck of sawdust; give it two coats of varnish; cook von hour."

Southern Pine in Bounteous Supply

Coming of the Turpentine Man, the Newest Danger--He Weakens the Trees and Causes Them to Fall Before the Storm

By T. H. Grosvenor of Atlanta, Ga.

Exhaust the pine timber of the Southern States? Not in a thousand years. Much of the Southern pine has been cut into lumber and shipped, but most of this has been taken from lands lying next to the railroad tracks and the river banks, where it was easy of shipmen . As this becomes exhausted, the lumbermen move their mills back into the interior and thus get a much larger supply.

During the past five years thoughtful saw-mill men have been investing larger sums of money in timber lands, but this was through no fear of the timber giving out, but rather to secure themselves against the expense of moving their mills at the option of the next land owner who refused to sell his timber.

Of late, however, a new danger has arisen. That is the coming of the turpentine man. At first he was thought to do little harm, as it was necessary only to bore a small hole in the trees and extract the juice, but it has been found that these holes so weaken the small trees that they are easily blown over by the wind and thus destroyed. There are however, thousands of acres that neither the turpentie man nor the mill has touched; again, there are many forests that were abandoned many years ago with the idea that the trees left standing were too small to saw. These have grown into good large trees now and add to the supply. I think it will take many years for any person to figure exactly when the supply will become exhausted.

OIL AND COAL FUEL IN THE AUSTRALIAN TRADE.

The laws of the Australian Commonwealth prohibit vessels carrying passengers and using oil for fuel from entering federal ports, but in spite of this restriction says the Shipping World, all the vessels of the Oceanic Steamship Company running between San Francisco and Sydney are being provided with oil burning machinery, a part of which is reserved for the use of coal.

By burning oil between San Francisco and Auckland, and coal between Auckland and Sydney the federal law is evaded. The advantage of the new system is the perfect cleanliness in the engine room and vicinity, and the temperature to which the stokers are exposed is reduced fully one-half. The operation of the burners is so simple that fire can be put out in a minute and a half and re-lighted in the same space of time. The oil tanks being separated from the cargo hold, and the fire room by coffer dams 4 feet wide makes the method perfectly safe.

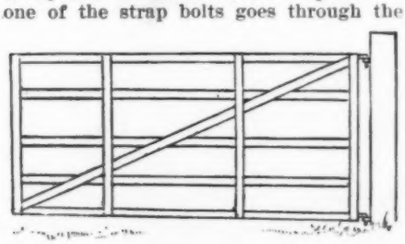
THE PICTURESQUE COLUMBIA river of Oregon exhibits more magnificent bluffs than can be found on any other stream of the world. The bluffs here shown are the culmination of a point on the river called Cape Horn. They rise almost perpendicularly 2,500 feet from the water's edge and are capped by tall trees. Water from numerous springs trickle down their sides, causing the granite walls to sparkle in the sunlight like crystal towers.

PRICE OF RADIUM DECREASES.

A chemist who has 200 milligrams of radium announces that he will sell the metal at the rate of $2,000,000 a kilo. This has caused a drop in the price of radium from $1,000,000 to $900,000 a pound. There are but two pounds of the precious stuff in the world. It is a powder composed of a combination of metals, procured by treating thousands of tons of uranium residues, and is one of the most important scientific discoveries of recent years. It gives off a light almost as strong as that from the sun and its value may be seen by the fact that with it a photograph may be taken through three feet of iron or a foot of lead. Speaking of the strength of radium, Prof. Curie of Paris, who discovered the metal, says that if a person were to go into a room where a kilo of the stuff was kept, it would destroy his eyes, burn all the skin off his body and perhaps cause instant death. It does not require light but will glow like phosphorus, even in a dark room. Prof. Curie, in carrying a bit of radium in a small metallic case under his arm, received a burn, like a sun burn, that required fifty days in healing. The value of radium to science cannot, as yet, be estimated.

A GOOD FARM GATE.

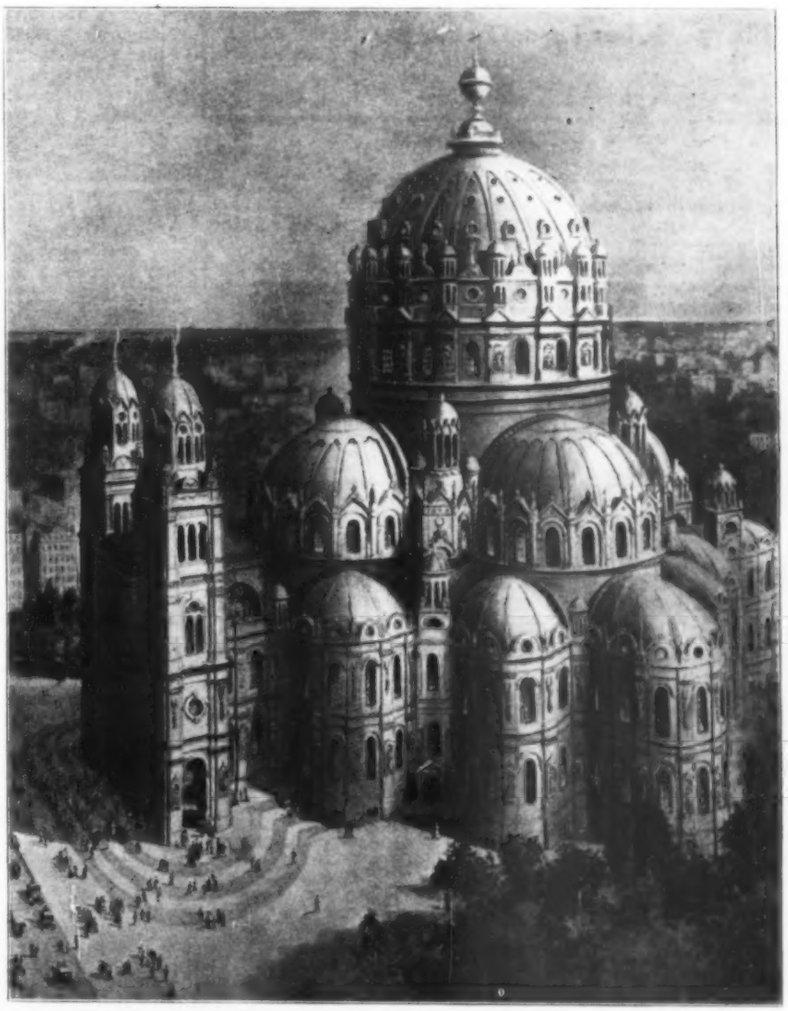
A writer in the Ohio Farmer describes a serviceable gate for general farm use. The gate is shown in the illustration. It is 12 feet long and 5 feet high and is made of five 6 x 1-inch boards. The bars are spaced about 4-6-9-11 inches from bottom to top. Three-inch strips are bolted one on each side of the bars at the ends with five-sixteenths bolts, two bolts in each end of the upper and under bar. At the hinge end these bolts hold the hinge. On one side of the bars a long tie comes from the top of the gate at the hinge end to the bottom of the other end. This is also bolted through the bars. On the other side two narrow strips are placed so that the bolt goes through the tie, a bar, and one of the strips. The gate is hung with hook and strap hinges, the upper hook and through the post with a nut on it, the lower one is driven into the post and one of the strap bolts goes through the



Farm Gate.

upper end of the long tie, thus preventing the gate from sagging. The two lower bars of the gate should be made of oak to turn hogs and an oak bar should be used at the top to prevent horses from gnawing it.

In Germany recently wireless telegraph messages were sent to various stations along a railroad from a moving train. The absolute reliability of the messages transmitted was proven.



American Church to Rival St. Peter's

Another Magnificent Cathedral Being Built in New York to Cost $25,000,000

Another great house of worship that is to be a wonder of the Western World is now rising in New York. It is the Roman Catholic Church of Nova Santa Sophia. The cathedral will attain a height of nearly 500 feet and will seat 71,000 people, 21,000 more than St. Peter's, Rome. It will be 500 feet long and 400 feet broad, and will have four semi-circular naves round the dome. Its cost will be $25,000,000. Except the Church of St. John the Divine, which is also being built in New York, it will be the finest church in the United States, and probably in the world. It will cost more than the British House of Parliament.

High Pressure Made Things Hum

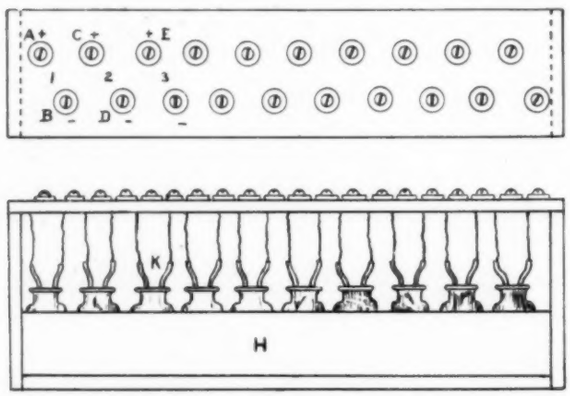
San Francisco Wood and Iron says: There is something about the hum of a factory that is moving at a lively gait which puts energy into the workman, when the same workman may get weary and listless in his movements when the machinery begins to drag. In other words, when the machinery of a plant begins to drag it take the life out of the factory and money out of the owner's pocketbook. There are times, too, the journal quoted says, when twenty pounds, or even ten pounds, more pressure at the power end of the plant will make the change from a slow to the lively in these conditions, and when a time like this confronts an engineer he is in for a job of thinking. If the power plant will stand the additional pressure with a little tuning up here and there, it is neglect bordering on the foolish to not make the change; but if the change calls for a pressure which is not safe or practical, under the circumstances, it is time for some additions to the power plant, and the engineer should urge that point. Under no circumstances, however, should a plant be allowed to drag continuously.

Easy Electrical Experiments

By L. P. Dickinson

AN EXPERIMENTAL BATTERY.

In order to run the arc lamp described in the previous chapter, a battery will be required capable of giving a rather high electro motive force and a considerable current. At least ten cells ought to be used, and if we try to construct bi-chromate or similar cells we would find it a costly and troublesome task. A simple storage battery may be easily



Simple Storage Battery

constructed which is capable of doing a number of interesting experiments and the cost is insignificant.

The jars for containing the fluid for our storage battery are made of empty horseradish bottles. The amateur can arrange to make as many cells as he sees fit, but at least ten will be required for our experiment. They are arranged in a long wooden trough shown at H in the accompanying figure. This trough is provided with upright strips at the end about ten inches high, across the top of which is a smooth flat board. The material of which this trough is made should be at least ⅞ inch thick.

Each cell is composed of two strips of thin sheet lead immersed in a solution of sulphuric acid. The strips of lead are about ½ inch wide and are long enough to project 2 inches above the top of the bottle. These are shown at K. To the upper ends of these strips are soldered pieces of copper wire such as bell-hangers ordinarily use. These wires are for the purpose of making connections with the various cells. The strips of lead are prevented from touching each other by a strip of wood which fits tightly in the center of the neck of the bottle and is long enough to touch the bottom. The liquid used in the cell is a solution of sulphuric acid in water. The proper proportion is one part of acid to twelve parts of water, and the mixture should be made by pouring the acid slowly into the water. The bottles should then be filled about ¾ full of the liquid, the lead strips inserted, and the wooden strips pushed into place between them.

We are now ready to arrange the connections of our battery. On the top of the wooden strip are mounted small copper washers as shown at A and B. These copper washers are arranged in two rows of ten each, and are secured by a small screw passing through the washers into the wooden strip. The terminals of cell No. 1 are connected to A and B. The terminals of cell No. 2 are connected to C and D, and the other cells are connected in a similar manner. When all connections are made the cells are ready for charging.

In connecting the cells for charging, all the copper washers in one row should be connected together by a strip of thin sheet copper and this strip is then connected to one terminal of a battery of three gravity cells connected in series. The other row of washers is similarly connected together by a second strip of copper, and this strip is connected to the other terminal of the gravity battery. An inspection will show that the cells are then all connected in parallel, and three gravity cells ought to give them a sufficient charge in one week, at the start. After this first charge they will charge enough over night to do considerable service the next day. After the cells are charged, the cells are all connected in series. This is done by removing the two copper strips just mentioned, and by connecting posts B and C, D and E, etc. When the cells are thus arranged in series, the electromotive force of each cell is added to its neighbor, and the combined electro-motive force of the whole battery is considerable. The capacity of the cells as constructed is not very great—that is, they will not yield a current for a great while at a time, but nevertheless, many interesting experiments may be performed by their aid.

ONE LINE WHERE PASSES GO BEGGING

Strange as it may seem, a transportation line has been found where passes are unsought, and when offered to people they are declined. More than this: even in the few cases where they were accepted they have since been returned. The general manager of this line proposes to take a trip soon in a special car which will have absolute right of way over all other trains. This manager has a world-wide reputation and would be lionized at any club in the world if he only would enter its doors. But when it comes to riding on his road, nobody seems anxious to be closely associated with him, and yet when he starts on the trip thousands will watch him go, and the event will be cabled to all parts of the world.

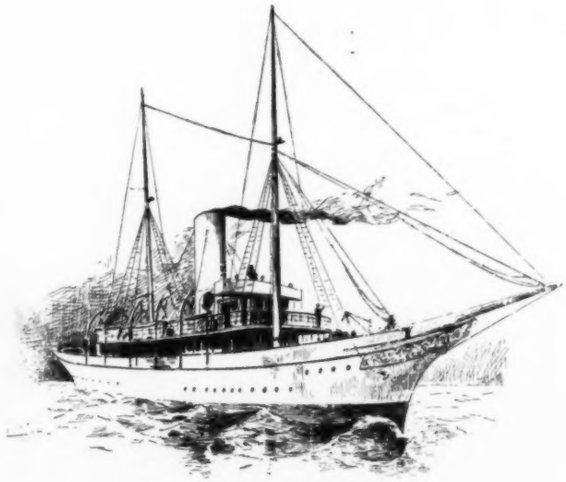
This manager is Santos-Dumont, and the trip is the trial one of his new passenger balloon, which will seat ten people. He says he will probably be obliged to make the first voyage with bags of sand in place of living beings. His depot is nearly completed and will accommodate seven air-ships, and he will have a fleet of three vessels in operation this summer.

Santos Dumont says:

"My union air-ship depot will be furnished with every possible convenience of modern science. It will permit experimenters to pursue their work in a more rational way, more economical and less dangerous. Especially it will suppress the periods of unprepared departures and landings. At each corner of the façade, in the plan, you see an observation tower. These will serve for meteorological observations."

FIRST TURBINE YACHT TO CROSS ATLANTIC.

The steam yacht Emerald, chartered by George Gould of New York, and which recently arrived in New York from England, is the first vessel fitted with turbine machinery to cross the Atlantic. During the voyage the vessel encountered bad weather but her excellent behavior during the stormy



The Turbine Steam Yacht "Emerald"

passage is considered due to her fine machinery equipment. There was no racing of propellers and no vibration or noise of the machinery even when a speed of 15 knots was obtained. The coal consumption was also found to be moderate, considering the weather. The vessel is of 756 tons yacht measurement.

Canal to Benefit the West

Cotton States and Manufacturing Interests to Receive Immediate Profit

By Henry Haarstick, president of the St. Louis and Mississippi Transportation Company

The cotton and western states will receive immediate benefit from the construction of the Panama Canal by the United States. The benefits will arise just as soon as these states commence to secure direct shipment to the Orient from some gulf port. All this will increase as time goes on. All that is needed is an opening.

All the freight from the Mississippi Valley to gulf ports is hauled over a water level. It makes little difference whether it goes by rail or river. The cost is about the same, as long as it does not have to be hauled over the mountains. With the Panama Canal, this freight will have to be transferred but once to get it into the Orient and so it can be shipped at the lowest possible cost.

I speak of the cotton states first, because it seems to me that the immediate results will be quicker there. Already there are large exports of cotton direct from these states, and when once a short all water route is established the benefits will be incalculable.

I look for no special benefit to the wheat growers. No grain is shipped to the Orient from this section, nor is it likely there will be; but the canal will be of benefit to the Pacific coast states in the event that the demand from China, the Philippines and Australia fall off. Then they will be able to save many thousands of miles in shipping their products to Europe.

The great benefit to the west will, I think, be to the manufacturing interests. At present Europe is furnishing the Orient with manufactured goods. With the opening of the Panama Canal, America will come in for a larger share, and the Mississippi Valley is nearer to the canal than the Atlantic coast.

As to the part the Mississippi River will play in the commerce of the valley and the Orient it is hard to say. At present river traffic is at its lowest point in history. The railroads seem to be filling the requirements. To such an extent are they doing this that we have reduced our equipment to a very low state. But if commerce increases and a demand is made for river service, it will be no trouble to furnish all the boats needed.

I do not, however, ever expect to see a through line of boats from any port to St. Louis. Laying aside the question of a deep waterway, the financial side of the question makes it impracticable. In order for a steamship to make any money nowadays it must carry from 14,000 to 16,000 tons. The cost of such a ship is not less than a million dollars. A string of barges that will haul the same load up or down the river would not cost more than one-fifth the amount, and the cost of running the barges would not be more than one-fifth as much. The deduction is easy.

The subject of the benefits to be derived from the Panama Canal is a broad one, but from my observation and experience in the matter of transportation, I think it is self-evident that the benefits will be, not only great, but immediate and direct to the Mississippi Valley and the West.

THE LIFE OF THE COWBOY

The cowboy of the present day is far from being the fierce untamable creature of ten years ago, or as popularly pictured by newspaper writers. There are still the same fearless, dauntless and determined set of men, but among them are many college graduates from the East, and the men who are to be the cattle kings a decade hence. With the cowboy a person goes for just what he is, and with no other class of men is deception so unpopular. They brave the storms of winter and the heat of summer in caring for their herds, and think nothing of a solitary ride on horseback of a hundred miles or more over the mountains with nothing but a faint trail to mark the way. The illustrations are from the pictorial edition of the Argus, Lewiston, Montana. The annual roundup is the great event of the year, at which time is gathered the finest body of horsemen in the world.

Cowboys at Mess

TO PREVENT RUST.

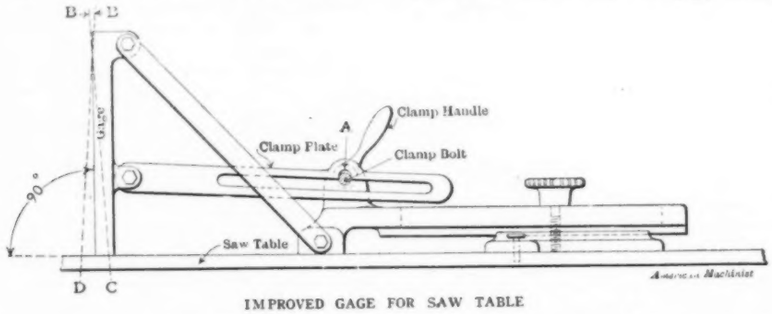
To keep machinery from rusting, says the American Thresherman, dissolve one ounce camphor in one pound melted lard; remove the scum; mix as much black lead with the lard and camphor as will give it an iron color; clean the machinery well; smear with the mixture; after twenty-four hours rub off; clean and polish with soft cloth.

Starting on the Roundup

SHOP NOTES

IMPROVED GAGE FOR SAW TABLE.

The sketch shows a saw table gage or fence which, like others, had one bad feature; that is, there was no provision made for setting the gage at right angles to the table, says American Machinist.



IMPROVED GAGE FOR SAW TABLE

This has caused a large amount of work to be spoiled, careless workmen often leaving the gage like B C or B D.

To overcome this trouble I made a new clamp plate with a notch at A to fit over the clamp bolt; when in this position the gage is at a right angle with the table. When the clamp plate is raised so that the notch is above the clamp bolt, the gage is free and may be set at any angle wanted.

COAL TAR AS FUEL.

Coal tar would seem to be about the most unlikely substance for fuel, but tests recently made show that under certain conditions it might even be economical to burn tar. The tar in question is a by-product of gas made from coal or oil. In order to burn it the supply must be at least 10 feet above the burners

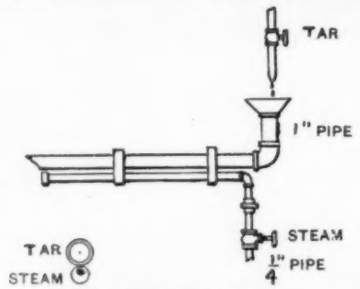


Fig. 1. Burner for Coal Tar.

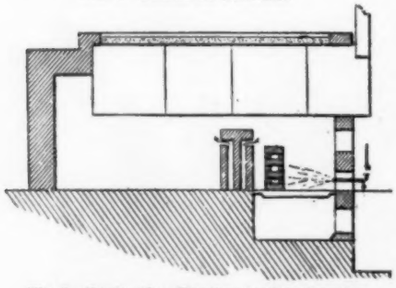


Fig. 2. Combustion Chamber for Tar Burning.

which may be almost any good crude oil burner. The Engineer says: The burner shown in Fig. 1 works very nicely, and, being made of ordinary pipe and fittings, can be made readily and cheaply.

Steam is discharged through a small hole less than 1-16 inch in diameter, drilled near the top of the cap on the end of the ¼-inch pipe. The overhanging sloping end of the tar pipe in connection with the jet of steam produces a good spray.

In starting a boiler a bed of fuel is necessary, but after a short time the heat of the furnace is sufficient to carry on combustion. It is well to have a large combustion chamber. The arrangement shown in Fig. 2, where the grates are located at the level of the ash-pit floor, will be found satisfactory. In this arrangement no air is admitted except through a 6-inch square hole around the burner, and a small amount admitted through ports on the bridgewall, as shown. This air passes in at ports on the front of the boiler and is heated in ducts in the side walls. This produces a small additional economy, but is not essential to good work.

Deflecting or confining arches or walls erected in the furnace will not last under the intense heat produced by tar burning at its best. A simple loose cob house of firebrick, as shown, is sufficient. This and the side walls of the furnace become highly heated and ignite the spray of tar, if from any reason it is extinguished.

SILOXICON.

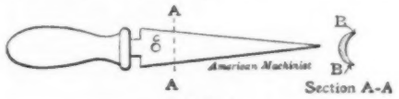
Siloxicon is a new refractory material, the discovery of E. G. Acheson who also discovered carborundum, the manufacture of which was fully described and illustrated in these columns. Siloxicon is made in an electrical furnace quite similar to that used in making carborundum. The raw materials are ground coke, sand, and sawdust. It is produced with a heat of 5,000 degrees, while carborundum takes 7,000 degrees. Siloxicon is a self-binding material and is used for lining furnaces, crucibles and the like.

At Sing Sing prison recently it took five shocks to electrocute Antonio Triola, an Italian murderer. State Electrician Davis says it is much harder to kill a thin wiry man like Triola with the electric current than a stout man, as there are not enough tissues to convey the fatal current quickly to a vital part. Triola's thick greasy hair is also said to have resisted the current.

USEFUL BELT TOOL.

Belt punches are expensive; it takes three or four of them to cover the usual range of work, and a hammer, block of wood and some good backing to hammer on are their essential accompaniments. The tool described herewith, though pretty old, is not so well known or so generally used as its advantages would seem to warrant, says the American Machinist.

Take a three-cornered file 6 to 8 inches long and tapering from ⅝ inch down, and grind it rounding on the back and hollow in front, as shown in cross section A A. At B B, by grinding and whetting, produce sharp cutting edges. Annealing the



Belt Tool.

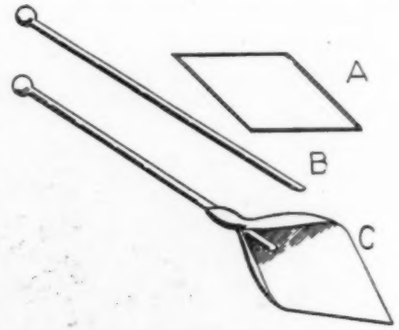
file facilitates the grinding, makes the edges B B more susceptible to the influence of the oil stone, and allows of drilling the 3-16 inch hole c, which comes in very handy in getting a hold on the belt-lace end for pulling it through. As may readily be seen, by inserting this tool into the belt and then making a complete turn with it, the lace hole is produced.

The holes made range in size from those suitable for wire lacing and produced by the point of the tool to those for ¾-inch rawhide lace produced by the widest part of the tool. The crescent-shaped cut made by its mere insertion into the belt is very suitable for holding the end of the belt lace. Burning the tips of a belt-lace hardens them and thus gives you good working ends.

HOW TO MAKE A BLACKSMITH'S LILY.

The American Blacksmith tells how to make this tool which is indispensable for packing or poking the fire, for putting flux on heated iron or steel, for removing slag and also for many other uses about the forge.

To make the tool, first cut out a piece of iron plate with bevel edges as at A. An old diamond-shaped cultivator shovel will do. Make the handle of ½-inch round iron, as shown at B, and weld the



Blacksmith's Lily

end of the diamond and the handle together, doubling the former around the end of the handle, as shown, which would shape it like the cup of a lily. The end of the handle should project one inch into the center of the cup. At C is shown the tool when complete.

SPLICE FOR WIRE ROPES.

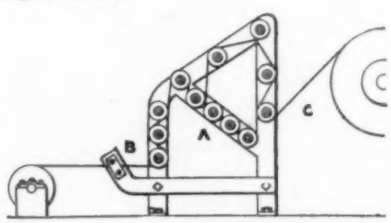
It often happens that a wire rope is cut into by a clay car or some other unforeseen accident, says Brick. A simple and quick but perfectly reliable way to repair the break is to take a 6-inch piece of black iron pipe which must not be more than ¼ inch larger in diameter than the wire rope, unravel the ends of the wire rope and insert into the pipe, so that the ends touch in the middle of the pipe. Now stop up one end of the pipe around the rope either with putty, or if that is not at hand with common mud. Hold the rope and pipe in a vertical position and pour enough babbitt metal in the pipe and around the ends of the rope to fill up the pipe completely, and the result is a splice that is ready for immediate use and is as strong as the strongest part of the rope. Of course the splice is intented to wrap around an 18-inch or 24-inch hoisting drum such as is generally used in brickyards. This wrapping around the drum or pulley is one reason why the pipe should not be over 6 inches in length. Where the diameter of the wire rope is not over ⅝-inch and the load to pull is not over one cubic yard of clay, the splice can safely be made with a ⅝-inch pipe only 4 inches long. This method is so simple and time saving that in case of an accident it is worth a trial.

REWINDING AN ARMATURE.

The process of winding the bindings on a large armature is described by The Engineer: The winders have a rig for putting tension on the wire, as shown at A in the accompanying drawing. The frame is made of 2 x ½-inch steel, with 3-inch pulleys bolted on it, as shown. These pulleys have a groove in the rim to take the wire. Two thin blocks of hard wood are bolted on the arm at B. These are to guide the wire to the pulleys and to put on some of the tension. The frame is fastened to the floor by lag-screws 8 or 10 feet away from the armature.

The end of the wire is made fast to the armature by soldering it to some convenient place, then the turns are taken around the pulleys, as shown. It is possible to get more tension on it by taking more turns around the pulleys.

The spool of wire is blocked up as shown, so as to be free to unwind as the engine turns.



Tension Used in Winding Armatures.

A man must stand at C to guide the wire on to the armature while the engine is turning over. Great care must be taken when stopping the engine that it does not drift back and slack off the turns; if this happens the engine will have to be backed and the wire wound back on the spool again, and a fresh start made.

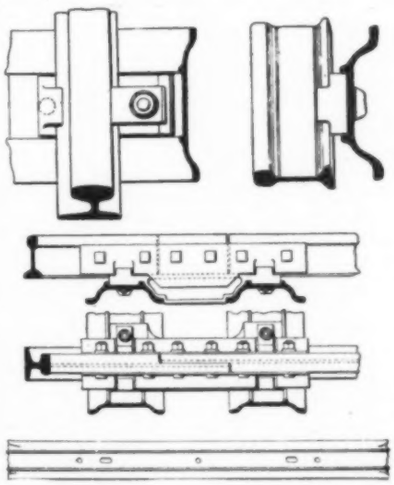
The bindings must be put on very tight when they are cool, for they have a tendency to expand and slacken when they get warmed up.

HOW TO ANNEAL STEEL.

To anneal steel place it in a clean fire, which has a good body of coke and which is banked well on the sides with green blacksmith's coal, says "Sparks." The steel should be covered well with live coals. Use a gentle blast and turn the steel from side to side so as to heat it evenly. When it reaches a red color, shut off the blast and leave in the fire a few seconds to allow the heat to distribute uniformly. Then take it out and place it in an iron box, surrounding it with clean pulverized lime. Leave there until cold.

METAL RAILROAD TIES IN GERMANY.

What is said to be a successful metal railroad tie is in use on the Koln-Hamburg line, Germany. A new shape has been used which allows tamping and



Metal Tie, Germany

does not weaken the tie. The Railroad Gazette says: The ties are 2.77 inches high; .35-inch thick; and a tie 8.86 feet long weighs 160 pounds. The tie rests on one foot of stone ballast.

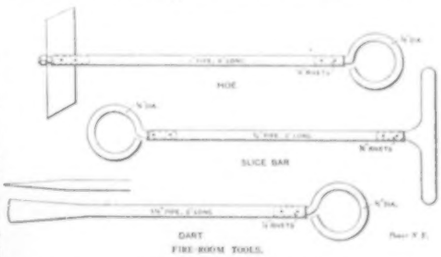
CASE-HARDENING.

In case-hardening, heat the metal to a good heat, sprinkle pulverized cyanide of potassium over the part to be hardened, hold it a few seconds until the powder is thoroughly fused and then plunge into strong salt water and leave until cold.

The government bureau of forestry has issued a bulletin giving instructions regarding a new system of tapping Southern pines for turpentine. This system, it is claimed, will replace the wasteful and destructive method of boxing, now used, and will produce 23 per cent more spirits of turpentine. The bulletin may be obtained by addressing The Forester, U. S. Dept. of Agriculture, Washington, D. C.

HOME-MADE FIRE ROOM TOOLS.

Power tells how to make a set consisting of the ordinary tools, viz., slice bars, rakes and hoes. These tools, however, instead of being made from solid iron



FIRE-ROOM TOOLS.

bars, were riveted to iron pipe of suitable size, thus making his tools very light yet strong. The accompanying sketch indicates the method and shape of each. These tools are far lighter to handle and yet will not bend as readily as the solid bars. A light hoe with a wooden handle and a long-handled shovel will make the cleaning of the ash-pit easier.

A HANDY HOG SCAFFOLD.

A handy portable hog scaffold which will hold five hogs, weighing 300 pounds each, is described by The Ohio Farmer. One can buy five large hooks, or have a blacksmith make them, at a very small cost; these are to hook over the beam, A, on which to hang the hogs. The top pieces also have a mortise 1¼ x 1½ in., and 6 ft. 10 in. long; this piece has two mortises, 3 in. from center, as shown in cut. The two upright pieces, B, are hardwood scantlings, 2x4 in. and 5 ft. 8 in. long. These have a mortise at the top 2 in. wide and 4 in. deep; also a mortise at bottom 1 in. deep and 4 in. long. These pieces also have a mortise 1½x1½ in., 2 ft. 5 in. from center to the upper end, for the tenon of brace, D, to go into. These pieces also have a mortise 2 ft. from lower end for brace, E, to set in. The sills, C, are 2x4 in. and 2 ft. 4 in. long. They have a mortise in center 4 in. wide and 1 in. deep; also a mortise 9 in. from center, for brace, E, to set into. D is a brace 1½x2½ in., and 3 ft. 4 in. long, including tenon which is 1½x1½ in. square and 4 in. long. E is a brace 2x3 in. and 1 ft. 11 in. long.

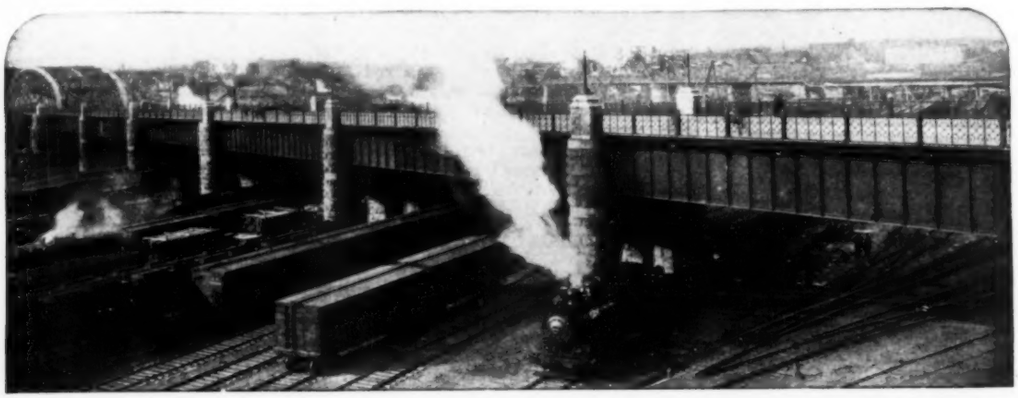
Portable Hog Scaffold

All that is required to put this scaffold together are two ¼-in. bolts, 5 in. long, to bolt the beams, A, to the upright pieces B, and sixteen 6-penny nails and two bolts 3 in. long to hold B and C at bottom.

ASSAILED BY SULPHUR FUMES AND SEA AIR.

Great New York Bridge That Withstands Dangerous and Continuous Corrosive Influences

The Union railroad bridge, crossing the Monongahela river at Pittsburg, was pictured in Popular Mechanics recently as a structure continuously exposed to the corrosive influence that would soon work its destruction but for the extraordinary precaution taken in its construction. Herewith is shown another bridge scarcely less dangerously situated. Spanning the great



Willis Avenue Bridge, Crossing Harlem River and N. Y., N. H. & H. R. R. Freight Yards, New York City

freight yards of the New York, New Haven & Hudson River railroad in New York City, the structure is an object of continuous attack by the sulphurous fumes from locomotives that pass below and the injurious sea air. Structures thus situated under ordinary conditions have decayed so rapidly from corrosion as to surprise their builders and cause great public alarm. This bridge, however, is built especially to withstand the continuous onslaughts of the destructive fumes. It is coated with Dixon's silica graphite paint; is built of very substantial material and special protection is given to the parts of the structure enduring the greatest exposure.

HOLLOW AXLES FOR HEAVY CARS.

Hollow axles are being used experimentally on heavy freight cars in the ore service of the Bessemer & Lake Erie railroad, and it is the opinion of some experts that they will soon come into general use. The fact that the heavy solid axles now in general use furnish so large a proportion of the dead weight of a car has led to the experiments with hollow axles. Properly speaking the axles are not hollow throughout, holes being punched in each end of the axle, leaving the middle solid. The length of the punched portion is made about eight times the diameter of the punch. Thus, a 3¼-inch hole would be punched in each end of the axle to a depth of 26½ inches. This punching process, which is the outcome of the work done by Mr. Camille Mercader at the Carnegie Steel Company's works at Homestead, Pa., and which had not hitherto been undertaken, also serves to test the quality of the steel used. Poor steel would show cracks on the surface after the punching. Experiments with the hollow axle show it to be even stiffer than the solid axle of the same outside dimensions. This is believed to be due to the greater density produced by the compression of the hot steel under the high pressure of the punch. If the steel in the axle is of the same strength for both solid and hollow it would, as Mr. Mercader says, appear from a simple calculation that the hollow axle should be about one-half inch larger in outside diameter at the punched portion than the solid, and the journal of the hollow axle of standard size would have about ten per cent less strength than the solid. It is estimated that hollow axles will result in a reduction of 33 per cent in the axle weight now hauled as dead load.

There is thirteen dollars worth of fertilizer in a ton of bran, in addition to the feeding value of it.

In San Francisco, it is said, the bones of deceased Chinamen are shipped to China marked fish bones. Forty-five packages of this kind were shipped recently.

A FRACTION OF TIME LOST.

If one grain of sand on the shore of the ocean were lost, and scientists were to spend years in trying to find it, they would be attempting a task resembling that to which the leading astronomers of England and France are now devoting themselves. One-sixteenth of a second is missing, and no one can tell where it has gone. Between the sun's time, as recorded at Greenwich and as understood at Paris, there is that brief and seemingly unimportant discrepancy. No expense is being spared to trace the missing fraction. A special building has been erected at Paris, costly instruments installed, a corps of mathematicians engaged, and a process that may take years to complete has been commenced. The inaccuracy is more important than will appear to the lay mind. Longitude is calculated on the basis of Greenwich time. It determines the boundaries of many countries. A slight variation of time may change the nationalities of thousands of people. The pursuit of the missing fraction of a second is, therefore, of world-wide importance. When it is found not a grain of the sands of time will be missing.

HIS HAT THE MEXICAN'S PRIDE.

One Sombrero May Represent Two Months' Work and Sell for $100.

A Mexican will often pay as much as $100 for his sombrero and $5 for the rest of his wardrobe. The making of the Mexican hat is another of those secret arts possessed by our southern neighbors which it seems impossible for others to acquire. Foreigners have strived in vain to learn the process of manufacture. In Mexico the secret is handed down from father to son, and the hats are always hand made. Instead of selling the hats in the stores, they are usually

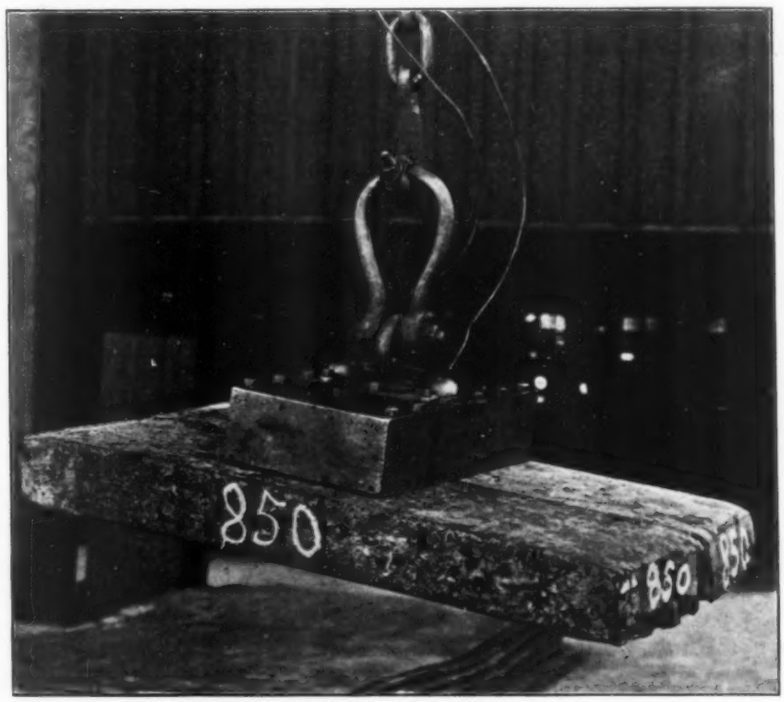
A Mexican Sombrero Maker

spread on the ground in the market place, in charge of one or two of the manufacturers. The hats thus exhibited are generally sold at from $15 to $100. One hat may represent two months' work of one or more persons.

Remarkable Lifting Power of Electro-Magnets

Five Ton Weights Suspended in Mid Air by Electric Force

If the electric crane were not in use some of the greatest industries in the United States would be obliged to suspend operations, for the electric current has become indispensable in lifting and transferring great weights from one point to another in the foundry, the machine shop, the ship-yard and elsewhere. The method by which these great arms are employed is well known. The plates on bars or girders are fastened to the crane by chains or wire cables, then swung into the air and taken here or there.



The electric current, however, has been applied in still another and more interesting form. The electro-magnet may, in the near future revolutionize the present methods of handling weights, in spite of the progress which we have already made in this respect. The principle employed reminds one of the toy magnet so popular with the children to pick up tacks and needles, but its force comes from the metal itself. The great magnets which are now being used in some parts of the west are given their power by the electric current. When a piece of iron or steel is to be taken from one part of the plant to another, loaded on the railroad car, or swung in the air for some purpose, the magnet is merely placed against its surface and the load taken wherever desired. No chains or other bonds are required to fasten it to the crane for the adhesion caused by the current is sufficient.

A visit to a plant where one of these magnets is in use, gives an impression of the wonderful power of electricity which is not soon to be forgotten. It seems almost supernatural to see a great mass of metal weighing perhaps five tons or more lifted and moved about as easily as if it were a slab of wood, yet not even a thread apparently holds it to the magnet.

The manner in which this power is controlled is exceedingly simple. A push of a lever or the pressure of a button is sufficient, turning the current on or off. Consequently the magnet can be taken to any place reached by the crane which supports it without affecting the iron or steel which may be in its vicinity. When it is ready for service the man who operates the crane merely turns on the current and it becomes "alive." When the slab or sheet has been carried to the place where it is to be deposited it is lowered to its resting place, the current cut off and the magnet instantly separates from it. Its power is only limited by the electric current conveyed to it. From 2 to 3½ amperes are usually sufficient to lift at least 5 tons on a current of 220 volts. For this purpose a magnet is used which weighs between 300 and 350 pounds. These are a very convenient size for ordinary industrial work, but should greater weights be handled it is only necessary to have a series of magnets so that the capacity of the apparatus is really indefinite. It is truly among the most remarkable labor savers and time savers which has recently been designed for by it two men can actually do the work of 100—one man to control the electric current and the other to guide the weight to its proper resting place.

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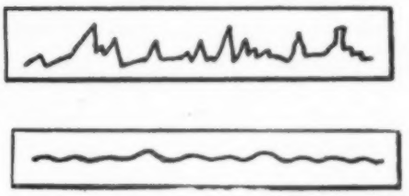
Persons disposed to think ill of the easy-riding qualities of automobiles have their opinions disputed by the following from Die Automobil-Welt: "There is the motor in the front of the machine, with its easy, elastic vibrations. The vehicle itself swings with it, but so softly that you don't notice it unless it stands still. When going, these vibrations actually reduce the shocks from a rough road, which, with a horse-drawn wagon, hit the body suddenly and harshly, throwing it from one side to another, hard and rude, even if the wagon has good springs. The motor vehicle has not only good springs, but also a lower center of gravity, besides pneumatic tires, by all of which the shocks are very much softened. And what still remains of irregular jolting is bridged over and smoothed out by the soft, undulating and uniform vibrations of the motor. You can imagine that you were sitting in a boat gliding over a rippling, slightly moved surface."

The relative ease of travel in a carriage and automobile, as set forth by the writer, may be shown by the accompanying illustrations, the upper one showing the jolting motion of the carriage on the road and the lower one showing the relative motion of the automobile.



Carriage vs. Auto

The Melbourne Journal of Commerce says:

Believers in petroleum providing the fuel of the future, have established installations for the supply of oil in pretty nearly every port of call between London and Yokohama, including every principal Australian port. Other depots are being established in the suburbs of Melbourne, with a view of bringing the supply as near as possible to the consumers. More would be done in that direction if the various municipal authorities were not, needlessly, but not unnaturally, afraid of the imaginary risks involved.

Cod liver oil is being adulterated with oil made from the livers of seals.

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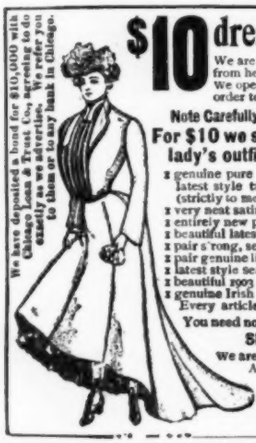
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1 latest style seal-grain leather belt.
1 beautiful 1903 pattern silk tie.
1 genuine Irish linen lace handk'f'f. Every article good honest value.

For $10 we send a complete man's outfit as follows:

1 latest style, pure wool or cheviot, tailor-made suit (strictly to measure).
1 Derby, Fedora or Panama style hat.
1 pair latest style satin calf shoes.
1 pair Lisle-finish hose.
1 suit underwear, heavy or light weight.
1 latest style percale shirt.
2 collars. 2 cuffs to match.
1 silk bow, teck or four-in-hand tie.
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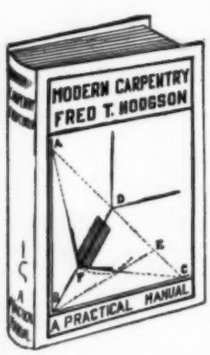

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A CAREER.

Brother Bill was a feller so skeered of mistakes
That he didn't do nothin' at all.
He criticised others for makin' small breaks,
But he didn't do nothin' at all.
He'd stand by the hour with his hand on his heart,
An' talk about taxes, religion or art,
An' we all said that Bill was uncommonly smart,
But he didn't do nothin' at all.

Us boys went ahead an' we worked with a will,
But he didn't do nothin' at all.
An' some of 'em turned up their noses at Bill
'Cause he didn't do nothin' at all.
But Bill is the pride of the fam'ly today,
They put him in Congress, well out o' the way,
An' he's takin' life easy and drawin' his pay,
An' he doesn't do nothin' at all.
—Washington Star.

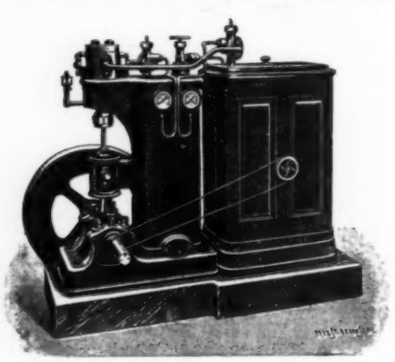
A tramp once to a back door came
And begged for food to eat.
The kitchen fairy looked askance,
Then said, with smile discreet:

"There is a wood pile just without;
If you saw a cord or two,
There'll be waiting, without doubt,
Some very nice hot stew."

The tramp, as he hurried out the gate,
Called back with loud guffaw,
"Just tell them that you saw me,
But you didn't see me saw."

NEW MACHINE FOR MANUFACTURING ICE IN GERMANY.

The accompanying illustration shows a new ice machine brought on the market recently by the firm of Wegelin & Hubner, in Halle, Germany. The compressor consists of a vertical suction pump, which is connected with an iron cask-like condenser by a hollow tube, writes United States Consul Harris. The



German Ice Machine

compressor draws the ammonia steam from the ice generator and presses it into the tubes of the condenser, where it is cooled by water which circulates around it. The tubes of the ice generator are submerged in a solution of salt and chlorcalcium. The process is simple, practical, and is especially adapted for use in tropical climates. The machine is so arranged that it may be propelled by gas, petroleum, or electricity.

To ascertain heating surface in tubular boilers, multiply two-thirds the circumference of boiler by length of boiler in inches and add to it the area of all the tubes.

While the solution of the airship problem may be near at hand, it is the opinion of nearly all engineers that the dirigible balloon will not solve it.

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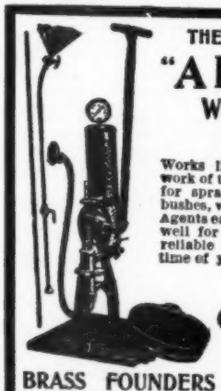

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HOUSE FOR DRYING CORN.

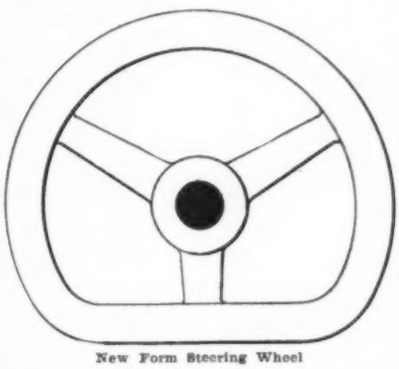
To properly dry sweet corn The Ohio Farmer suggests a drying house, the plan of which may be seen from the illustration. The upper floor contains grain bins along the north side while the south half of the upper floor and the entire lower floor are arranged for sweet corn. In order to get a free circulation of air to dry the corn, doors are cut on all sides of the building. The corn to be dried is

Drying House for Corn

laid on racks made of 1x3-inch slats and placed one above the other with a space of twenty inches to two feet between. If the corn is green and milky when husked, it should be placed on the racks very thin, not more than several layers in depth, and turned frequently; but if it is comparatively dry; it may be put on thicker. In this building five or six hundred bushels may be dried.

NOVELTY IN STEERING WHEELS.

The form of steering wheel illustrated allows freer access to the operator's seat than the ordinary circular wheel, according to the Motor Age. It also dispenses with the break joint in the steering post, which is in some cases absolutely indispensable on account of the location of



New Form Steering Wheel

the steering wheel. If this wheel be set perfectly parallel with the front axle, it will have the advantage of assisting the driver in making a straight course.

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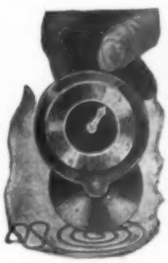

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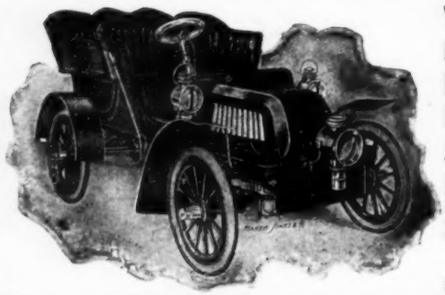

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